

Novel Approaches for Spacecraft Formation Robustness and Performance using Distributed Estimation, Control and Communication, Phase I

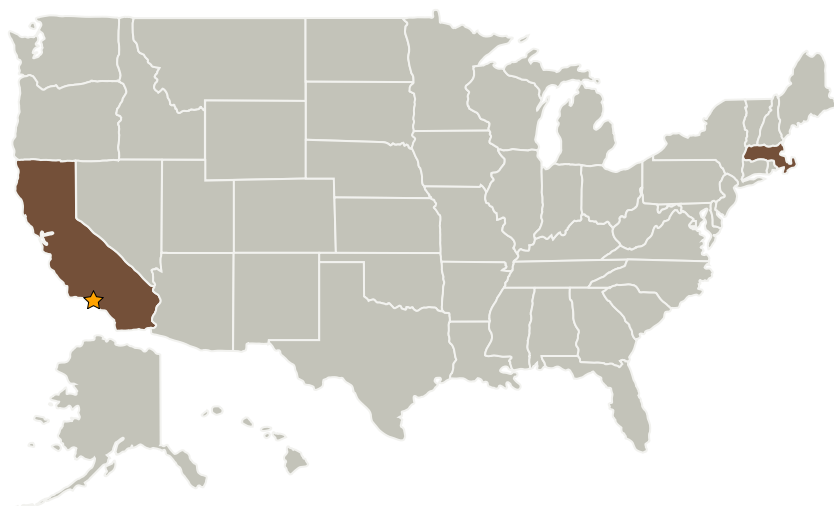
Completed Technology Project (2008 - 2008)



Project Introduction

Formation flight can provide the benefits of a large effective telescope using precision formation flying of smaller, lower cost, collaborating telescopes. A decentralized architecture for estimation and control provides several key advantages including reduced communication and processing overheads as well as increased tolerance to a single point of failure. Since a decentralized design relies on communicating information between individual spacecraft, it becomes critical to enumerate and quantify the effect of information sharing on estimation, control and guidance systems performance for the entire formation. The goal of this project is to analyze these interactions between information communication, estimation, control and guidance systems as well as to develop analysis tools to help the TPF1 team evaluate various trade-offs involved in designing these systems. During the proposed effort, we will bring together new advances in the fields of Robust Control, Risk Sensitive Optimal (RSO) control, and Covariance Intersection (CI) to combine information shared across the formation. We will study the impact of communications topologies on estimation performance, develop methods to reduce disagreements between parallel estimators, design control and guidance laws that are robust to estimation disagreements and study scalability issues for formations with large number of spacecraft. Phase I effort will also deliver a software analysis tool to help the NASA TPF1 team evaluate trade-offs for candidate TPF1 architectures.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Scientific Systems Company, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Woburn, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Lingji Chen

Technology Areas

Primary:

- TX10 Autonomous Systems
 - ↳ TX10.1 Situational and Self Awareness
 - ↳ TX10.1.2 State Estimation and Monitoring